Claims

Sub A3

[c1] 1.A method for examining structures on a semiconductor substrate (7) that has a thickness, the method comprising:
-penetrating and imaging of the structures with X-radiation (1) in an imaging X-ray microscope onto a spatially resolving detector (9, 12); and
-establishing of a wavelength or a wavelength region of the X-radiation as a function of the thickness of the semiconductor substrate (7) in such a way that the transmission of the X-radiation through the semiconductor substrate (7) is at least sufficient for detection of the X-radiation and for obtaining a high-contract image.

[c2] 2.The method as defined in Claim 1, further comprising reducing the thickness of the semiconductor substrate (7) without affecting the structures.

[c3] 3.The method as defined in Claim 1, wherein the semiconductor substrate (7) is made of silicon, the substrate thickness is less than 30 μ m, and the X-radiation has a wavelength between 0.1 nm and 2 nm.

[c4] 4.The method as defined in Claim 1, wherein the wavelength of the X-radiation is selected in accordance with the Rayleigh-Gans algorithms for scattering to provide an optimum X-ray optical scattering capability for the structures on the substrate (7) in order to obtain a high-contrast image with a high signal-to-noise ratio.

[c5] 5.The method as defined in Claim 1, wherein the wavelength of the X-radiation selected for the examination of metal structures on the substrate (7) is in the vicinity of the corresponding absorption discontinuities of the metals, resulting in a high image contrast.

[c6] 6.The method as defined in Claim 1, wherein the X-radiation impinges upon the semiconductor substrate (7) at a side containing no structures.

[c7] 7.The method as defined in Claim 1, wherein the structures are imaged at different observation angles in order to allow stereographic and tomographic

reconstructions.

[c8] 8.The method as defined in Claim 1, wherein the X-ray microscope is operating in phase contrast to provide a minimum number of photons and minimal exposure time for obtaining an image.

[c9] 9.The method as defined in Claim 1, wherein a segmented phase plate (2a, b, c) is used in the back focal plane of the X-ray objective.

[c10] 10.The method as defined in Claim 9, wherein a segmented stop (29) disposed between an X-ray source and a condenser (3) of the X-ray microscope is used.

[c11] 11.The method of Claim 10, wherein a segmented annular condenser zone plate (19), or a rotating condenser (13) having a chopper disk, is used as the condenser (3).

[c12] 12. An imaging X-ray microscope for examining structures on a semiconductor substrate (7) having a thickness, the X-radiation microscope comprising:
-an objective (8) for imaging the structures with X-radiation on a spatially resolving detector (9,12); and
-an X-radiation source (1a) generating the X-radiation having a wavelength which is a function of the thickness of the semiconductor substrate (7), wherein transmission of the X-radiation through the semiconductor substrate (7) is at least sufficient for detection of the X-radiation, and for obtaining a high-contrast image.

[c13] 13.The imaging X-ray microscope as defined in Claim 12, wherein a segmented phase plate (20) is disposed in a back focal plane of the X-ray objective (8).

[c14] 14.The imaging X-ray microscope as defined in Claim 13, wherein a segmented stop (29) is disposed between the X-radiation source and a condenser (3) of the X-ray microscope.

[c15] ~~15.The imaging X-ray microscope as defined in Claim 14, wherein a segmented annular condenser zone plate (19) or a rotating condenser (13) having a chopper disk is provided as the condenser (3).~~